DATA AND EXTENDED FUNCTIONS OF A READING ROOM

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ABSTRACT

Reading is the main way in which people acquire information; the function of a paper information reading room is to understand public habits, create an environment, and make a "readers' space" to link users with information. In English, the word "information" is used to indicate the Chinese word "信息." This word has several meanings in English: news, intelligence, knowledge, report, speech, lecture, notice, service platform, inform, tell, [computer] information. It is clear that "information" is a word with a wide range of connotations. According to Wang (1986), "information is a signal from the universe that is combined with a media substance. Information is from a substance, but it is not the substance where it is from. It is a new substance, a combination of medium and signal. Such change occurred in the twinkling of an eye" (Wang, 2005). In this paper, we discuss the meaning of information and present ideas about how paper-oriented reading rooms have become digital and how digital reading rooms can be extended to cybercafés, TV, radios, and telephones.

Keywords: Reading room, Cybercafé, Digital reading room, Digital library

1   FOREWORD

We are living in an information world. People receive information by hearing, touching, reading, and tasting. 80% of knowledge is obtained by reading and 90% by sight. Using media facilities to read is an important method for people to acquire information.

2   EXAMPLES AND FUNCTIONS OF THE PAPER INFORMATION READING ROOM

Conditions of a paper information reading room include professional classification, a collection of books, facilities, and management. Here is a detailed list of fixed assets of a traditional reading room - the Beijing Information Science & Technology University Library reading room in the Qing He campus: 500 m² in area; 26 reading desks; 160 chairs; 21 five-layer iron periodical frames; 3 six-layer iron periodical frames; 8-four layer three basket newspaper frames; 2 work desks; 2 computer desks; 3 office chairs; 1 magnetic antitheft machine; 55 fluorescent lamps; 14 fire emergency flares; 50 m of fire hose; 1 spray gun; 4 fire extinguishers; 8 electrical funs; 1 blackboard; 20 3x2m curtains; 2 5x1 curtains; mop; broom; dustpan; wipe cloth; 12 plastics barrels; the book collection: 5 volumes of Chinese books and an information work library, 2 volumes of a new century Chinese-English dictionary, an economic trade finance dictionary, a Longman modern English dictionary, an English-Chinese technology dictionary, a collection of meeting papers, alumni records of Peking University, Tsinghua University, Renmin University of China, Beijing Normal University, Chinese Agricultural University, etc.. The office facilities have: one computer; one telephone; and one door curtain.

Reading rooms are classified according to natural sciences, social sciences, books, newspapers and periodicals, comprehensive, languages, self-study, etc. Except for self-study rooms, each paper reading room contains some books, magazines, and newspapers that are not shelved and are available for readers' immediate use.

Table 1. Make up of 11 universities' reading rooms

University name	Library area (including reading region)(m^2)	Reading room locations	Reading seats (places)	Open time (hours/week)
Peking University	56120	12	5000	85
Tsinghua University	27820	16	2000	85
Beijing Industry University	20000	13	2000	99．5
Nankai University	32200	18	2200	114
Zhejiang University	84000	24	6800	75
Northwest University	62637	18	2480	105
Fudan University	30033	14	1900	78
Nanjing University	20000	12	1300	78
Shenzhen University	23000	18	2000	103
Hongkong Science and Engineering University	16667	6 (reading Regions)	3557	70

Taiwan Central University	4000	20	1436	95

(May 30, 2006)

A paper information reading room is a cultural and educational mechanism that collects, preserves, and makes use of books, newspapers, and periodicals to serve readers. Most information in reading rooms is in the form of printed-paper materials, and catalogue cards and retrieval periodicals are used to reflect information about the collection of books. Only by coming to reading rooms can readers obtain the needed information. Most processing work in reading rooms is done by hand. Librarians in reading rooms classify documents into classical, excellent, common, inferior, and waste material categories during the course of classifying, cataloguing, and ordering. Documents in a reading room are also classified into languages, subjects, age, and size. A reading room undertakes the duty to provide useful and effective information to readers. When processing materials, librarians order, check and accept, register, catalogue, loan, duplicate, collect, inquire, bind, etc. This process not only is complicated but also needs stable workers and facilities. On the one hand, there are a large number of books, newspapers, and periodicals in the market; on the other hand, a reading room has limited resources for ordering. The selection of materials in reading rooms is limited to some extent, and when users inquire about information, they often have no success. There are also many tasks in reading rooms that must be completed by workers. For example, arranging bookshelves, being on duty, putting the printed materials in order, and cleaning rooms cannot be done by a computer. (Wang, 2005)

In the Chinese media market, book publication is 33.6%, newspapers are 6.1%, and periodicals are 9.2%. We can see that paper media information is generally in a developing stage. A reading room is a place where information resources are concentrated, and books are the main information carriers. The market for books is increasing throughout the whole world: 0.8 million books are published each year, and the quantity of book publication is rising in most countries. At the beginning of the 1980s, China's mainland had published 3.7 billion copies of new books with ten thousand different titles. This number rose to 6.44 billion with 220,000 titles by 2005, and is continuously increasing. According to the Top 100 list of daily newspapers issued in May, 2005 (from the World Association of Newspapers), China had 28 daily newspapers, including 23 daily newspapers from China's mainland and 5 daily newspapers from Taiwan. The Newspapers Development Report of China 2005 reported that China had 1992 different newspapers, which accounted for 14.5% of the world's daily newspapers. The quantity of Chinese daily newspapers is a hundred million copies, ranking first in the world. Each thousand people in China have 75.8 copies of newspapers. China has 9490 different periodicals, but most are only published in small quantities. There are only about 20 periodicals whose published quantity exceeds one million copies. Reviewing the last 20 years in China, about 2.5 billion to 3.0 billion copies of books, newspapers, and periodicals have been published. There is no periodical in China with more than 5 million circulation, while most publish from 1 million to 3 million copies. In China, each person has 2 copies of magazines per year, less than Japan, America, and Europe. According to data from the General Administration of Press and Publication of the P.R.C., in 2005, printed books, newspapers, and periodicals used over 210 billion pieces of paper, which is over 4.86 million tons of paper and 10.44 kg paper per person. The corresponding number per person in America was 146 kg, 118 kg in Japan, 112 kg in the UK, 94 kg in Germany, and 93 kg in Holland. With the increase in new publications, a reading room must use modern science and technology to collect, order, store, disseminate, and apply all kinds of information with computers. Paper in reading rooms

must be renewed continuously. Reading rooms exhibiting information on bookshelves have special people to manage the material, serve the readers, and respect the reading habits of the public by taking great effort to make the library surroundings and buildings a "readers' space." They allow readers to sit calmly at the desks, swimming in the sea of books, and reflecting an ideal of public life. The librarian of a paper information reading room is looked upon as a storekeeper, worker, and manager. (Wang & Liu, 2005)

3   A DIGITAL-READING ROOM

The main characteristic of a digital-reading room is that information entering each reading room exceeds the scope of paper information. With effective technology support, digital-reading rooms can provide reading services all around the world. Today, spreading and using digital information has played an important role in people's productivity and lives. Non-paper information goes almost anywhere. The huge amount of digital information, as well as the combination of telecommunications, computer, networks, and human consciousness, spreads videos, text, and pictures very fast. Therefore, information carriers and methods of management in reading rooms have changed significantly (Wang, 2005). This change means that readers can enjoy service without coming to the library, so the distance between consumers and information is bridged. Since 1994, the American government has invested 22 million U.S. dollars to carry out "an innovation plan of a digital library" in Carnegie Mellon and five other universities. They have employed information technology to transform paper information into digital information and then delivered the digital information to the Internet (Wang, 2005). By 2005, there were many cities and universities that used the Internet and had built digital-reading rooms. Here is an overview of several digital-reading rooms in several main public libraries in China.

3.1 Digital-reading rooms in the National Library of China

The National Library of China, located in Beijing, has 46 reading rooms. Among these are 23 open-shelf reading rooms, providing 2.1 million copies of books for readers. It is open 365 days a year; 13.36 thousand people visit everyday with 70000 copies of documentation circulated each day. It contains eight digital-reading rooms, linking 37 Chinese databases and 77 foreign language databases via the Internet. Its retrieval system had an OPAC consolidated catalogue, including 16000 copies of electronic periodicals, doctoral treatises, conference proceedings, and enterprise name lists. On September 20, 2005, the National Library of China opened its digital resources with no copyright to all readers in the country free of charge with more than 70 million pages. The second-term project of the National Library of China, to be finished by 2007, will provide 10 million items (contents, booklists, catalogues) for readers, digital resources of the Internet and Intranet, and add 600 seats to the digital-reading rooms. According to its construction objective, the whole system will have the capability of: transforming 300 thousand copies of paper information into digital information each year; finishing 3 million sheets of microfilms; dealing with 90 thousand pieces of booklists, abstract lists, digital resources; marking and referring to 6000 hours of audio-visual resources; 60TB of on-line storage; 340TB of near-line storage; 340TB of off-line digital resources; 6000 information access spots in the library; Internet resource output beyond 1TB/day; 3000G/second access band width; 100 thousand retrieval requests/minute; 0.2 billion pieces of metadata retrieval; providing 0.1 billion pages of full text retrieval resources.

3.2 Digital-reading rooms in the Capital Library of China

The Capital Library of China is located in Beijing. It has 15 reading rooms with 2000 seats and two

digital-reading rooms. The digital-reading rooms have 90 computers, providing services such as reading on-line, downloading, printing, scanning, recording, etc. The audio-visual reading room has 80 computers, providing services for broadcasting, CD-ROMs, DVDs, etc.

3.3 Digital-reading rooms in the Shanghai Library

The Shanghai Library has 25 reading rooms, 1651 seats, and 2 digital-reading rooms. There are 70 computers in the network learning reading rooms, providing on-line services, and 132 computers in the multi-media newspaper reading room, providing an index for national newspapers and periodicals as well as the Chinese news index service.

The digital-reading room is a cultural mechanism that relies on modern communication technology and digital processing technology to collect, arrange, display, and circulate information to serve people who study, play, and research in it. Today we have realized access to publications through codes such as ISBD, ISBN, ISSN, ISTP, and ISSHP with digital methods on a network. Digital-reading rooms also link networks and non-paper management, putting information on Intranet, and providing reading services in reading districts. A digital-reading room can be several hundred or just several square meters in area; reading, viewing, and listening can be in or outside, that is to say, in a room or an outdoor environment. The area needs only a reading desk or other flat space, a seat, and a computer linked to the Internet, providing service to any reader. An information spot is the extension of reading room that has only a port used for a wired or wireless linkage to the Internet. The objective of a digital-reading room is to provide complete, new, fast, and accurate service for readers all over the world (Wang, 2005). Librarians working in digital-reading rooms must master information technology and two subjects of knowledge; otherwise they do not meet the needs of the modern library. This requirement is remarkably different from that of librarians in the past. A qualified librarian now must know a foreign language well because 80% of the information from Internet is in English. If a librarian doesn't know English, he cannot fulfill his job (Wang, 2005).

4 INFORMATION SPACE AND FUNCTIONS OF DIGITAL-READING ROOMS

Digital-reading rooms collect digital information. In English the word "information" is used to indicate the Chinese word "信息．" This word has several meanings in English: (1) news, (2) intelligence, (3) knowledge, (4) report, (5) speech, (6) lecture, (7) notice, (8) reception desk, (9) inform or tell, and (10) [computer] information. It is clear that "information" is a word with a wide range of connotations. Therefore, there are many answers to the question "what is information?" According to the theory of electromagnetic fields (Wang, 1986), it may be expressed as "information is the combination of the signals from the universe and the communication media." Information is a substance, but it is not the substance from which it originates. It is a new substance that combines media with signals. Such a change occurs instantly (Wang, 2005). According to this definition, people use digital-reading rooms to do all kinds of viewing and listening activities and extend the use from audiovisual studio, video recording room, and research room, to the outside. The digital-reading room is part of Internet information communication media, and the Internet is in limitless space. Therefore it extends the reading space from a room to an outdoor area and then to limitless space, an inevitable development. The major reading service in a digital-reading room is on-line access, with an alternate usage of readable magnetic storage media. The functions of digital-reading rooms are discussed below.

4.1 Information database function

Library has another meaning, "literature warehouse." That is to say, the essence of information management is managing databases. Main requirements of databases in a reading area include: a DBMS (database management system) and a DBTG (database task group). Because of the large amount of information in the database of a digital-reading room, it is easy for network jams to occur; for this reason, reading rooms must use DDB (distributed databases) technology to support the networked retrieval. DDB provides client/server integrated data processing, while a DBMS can support hundreds of consumers at the same time and link users to many of the world's databases. This technology has matured and has several types (Zhang, 2002). Large and medium-sized digital-reading rooms generally can link dozens of databases.

The database functions of digital-reading rooms include both storage and on-line. Readers can read on the Internet, search for anything in global scope, and download and print the information they need. They also can use CD-ROM, DVD, E-BOOK and so on, to read special information. For example, Microsoft Corporation's electronic multi-media encyclopedia, Encarta, which is a CD-ROM (650MB) weighing one ounce, can hold 26 thousand paper summaries, 9000 thousand words, 8 hours of sound, 7000 photos, 800 maps, 250 interactive charts and 100 clips. It costs less than US$100; the price of the encyclopedia containing the same content in print or other media forms can be several hundred or even a thousand dollars. This technology not only saves storage space but also caters to viewing texts and pictures, while simultaneously listening to music or speaking.

Large storage equipment such as Magnetic disk arrays, CD-ROM Juke boxes, or auto-changers provide enough space for a modern library to transform paper information into non-paper information. For example, Kodak produces the Model 12000 CD-ROM Juke box system, which can hold 1500 thousand copies of books; its capacity is 1.48TB (ten hundred billion bits), equivalent to the collection of a large and medium-sized library. Hitachi has a new technology that can seal and package 200 films onto one DVD, which records 400 hours of video information. Sony has a new method that can raise a recordable CD's capacity twofold, from 700MB to 1.4GB. E-book also has a large market in China. In 2004, China sold totally 8.05 million copies of e-books - 2.6 times that of 2003; by April 2005, China had published 148,000 kinds of e-books, ranking the first in the world, and had more than 1000 digital-reading room users.

In an information society, the quantity of information is so large that no library can collect it all. There are about 3000 large-scale worldwide databases in the world; 70% of them are in America. In 2008 the global database software market volume will reach 20 billion US dollars (IDC). The urgency and demand for information by readers is greatly increasing; therefore, we must construct and enjoy together network resources, make network libraries, and cooperate with each other to solve the problem of information resources.

4.2 Storage functions

Another meaning of "Library" is storage. Modern computer technology, communication technology, optics technology, and other resources are used in digital-reading rooms to build a foundation to serve the readers. This work has changed from manual to automated. The information media of the reading room consist of not only books, magazines, and newspapers but also of pictures, maps, photos, tapes, etc., all having very large quantities of information. For this reason, it is necessary to prepare storage equipment with a large capacity. With the progress of storage technology, information media such as tape and light storage devices can hold a large

amount of information. Since 2005, we have seen large magnetic disks in the markets of western countries, which can hold several thousand million bits. Hard disks with unit GB have increased 29% each year, and hard disks with unit TB (1000GB) have been introduced into the market. A digital-reading room is one of the largest social units having the greatest amount of information storage, so it demands a higher level of network storage technology, a high-density optics storage system, and a buffer storage disc to link with global databases.

4.3 High speed retrieval function

Retrieval speed is a key technology in a storage system. For example, Idenken's database, the major public patent database of the Japanese government, is one of the three major biological databases in the world. It contains 3500 hundred million records, 398 hundred million groups of DNA models, and its volume is doubled every year. Because more than 10000 consumers visit Idenken everyday, the first problem it must deal with is quick retrieval. Its prototype computer system was based on a relational database, which needed 10 minutes to complete searches of two to three keywords. Now, however, the time has been reduced to 5 seconds. Only with convenient, quick, and timesaving retrieval, will the public use the digital-reading room.

4.4 System maintenance function

Network security must be dealt with when managing a digital-reading room. Many thousands of computer viruses have been discovered throughout the world. In 2004, the information security staff of IBM scanned about 126 hundred million e-mails; more than 96 hundred million were spam, about 73% of total. The world spent 700 hundred million US$ to get rid of network spam every year (including the time expended for deletion). As network systems become more open, the need to get rid of viruses and spam becomes greater. According to the news from the Ministry of Public Security, among China's Internet users, the computer virus infection rate was more than 80%. Chinese users receive a total of 60 million pieces of spam everyday. The stipulation of the Internet safeguard technology measure was issued by the Ministry of Public Security and was carried out on March 1, 2006 (Hou, 2006). The network system of digital-reading rooms, which contain a large quantity of information, has higher use frequency and is more often invaded by viruses and hackers. Therefore, adopting high-efficiency antivirus software, enhancing daily system maintenance, and finding and resolving security problems in a timely fashion to ensure the system's normal operation is absolutely necessary. In digital-reading rooms, information renewal time on the Internet has been shortened, and the rate increase has also increased the workload of deleting the false and keeping the true The more open the digital-reading room, the higher the technology level required for killing viruses and getting rid of rubbish. It is an important job to control and manage digital-reading rooms.

5 EXTENDED FUNCTIONS OF DIGITAL-READING ROOMS

When digital-reading rooms are compared with paper information reading rooms, their functions have been extended.

5.1 Cybercafé

A cybercafé is an independently managed outside library with service as its objective, a new kind of digital-reading room. In December 2006 in China, there were about 100 thousand cybercafés having more than

5 million computers. This number has increased by 20 thousand cybercafés and 2 million computers each year. According to statistics, in GuangXi, China, there are 4270 cybercafés with 220 thousand computers and one million users online everyday. The investment in cybercafés accounted for a quarter of the culture market of GuangXi at the end of 2005. Most cybercafés are built around colleges and universities and are a large part of student life, study, and entertainment. A cybercafé complements the digital-reading rooms of university libraries. For example, in the 500 meters from the roadside around HeBei Industrial University, there are 19 cybercafés with 2300 computers, open 24 hours each day and having a box-office rate of 70-80% during the day. In June 2005, Xu Zhou Municipal Library in Jiang Su, China built a "green cybercafé" on its second floor with an area of 740 m^2 and 96 new computers, providing a place for adolescents to go online. Shan Xi Provincial Library built the first "children's green digital-reading room," located in the children's room of the library, covering an area of 50 m^2 with 15 computers providing Internet surfing, online retrieval, email, and computer training.

5.2 Television

Watching TV is a type of reading activity in an extended meaning. IPTV (Internet Protocol Television) can transfer most of the Internet functions onto TV. Britain has publicized IPTV since 1999; by 2005, there have been more than one million IPTV users in the globe. The MRG Company estimated that IPTV would reach 26 million users by 2008. Now there are 1.4 billion TVs in the world, with 400 million in China (Qu, 2006). China has 3.6 hundred million families possessing 3.5 hundred million TVs, with an increase rate of 10% each year, 2058 TV channels covering 95.29% of the country's population, a hundred million cable TV users, 10 million hours of television broadcasting, a TV audience of 10 hundred million, and a stable average viewing time of 3 hours per person daily. The difference between a digital-reading room and a digital-family is the provision of social services. Those TV users linked with digital-reading rooms are in: 1) reading rooms for the deaf-mute, 2) public DVD broadcast rooms, 3) public TV broadcast rooms, 4) audio-visual centers of school libraries, and 5) any rooms providing TV broadcast service.

5.3 Radio broadcast

Sound information is spread by broadcasting and received through the sense of hearing. There are 306 radio stations, 360 television stations, and 1300 radio and television stations in the Chinese mainland; 1933 radio channels cover 93.21% of the total population. There are 189 thousand satellite radio receiving stations and 32 central radio station channels reaching listeners at home and abroad. There are 40 languages broadcast within the country and 43 languages (38 foreign languages, Putonghua, and 4 Chinese dialects) broadcast abroad. National radio stations have an average daily broadcasting time of 20317 hours. Broadcasting is one of the main media for the residents of China's mainland. There are 75 million persons acquiring information from radio broadcasts. This number is less than that for TV and newspaper but more than that for magazines and the Internet (Wang, 2002). Those radio users are linked with digital-reading rooms in: 1)reading rooms for the blind, 2)CD broadcast rooms of libraries, 3)public spots where radio broadcast is available, 4)audio rooms in school libraries, 5)any rooms that provide radio broadcast service.

5.4 Telephone

Telecommunication is one of the industries having the most rapid development. The number of global mobile telephone users is increasing at about one million each day, but this is only the beginning of mobile technology's

dissemination globally. There will be 901 million mobile telephone users in the area of Asia and Pacific, excluding Japan, by 2009. The number of Chinese mobile telephone users is 317.27 million, and this number will increase to 535.37 million by 2009 (IDC). The Ministry of the Information Industry of China noted that by the end of September 20, 2006 the number of total telephone users in the whole nation had reached 805.406 million, among whom were 367.931 million fixed telephone users and 437.475 million mobile telephone users. The total number of short messages sent was 3046.5 hundred million pieces in 2005 with a 39.9% increase over 2004; mobile telephone short messages sent were 2736.7 hundred million pieces from January to September in 2006 with a 46.3% increase over the same period of 2005. As for telephone use rate in China's mainland, fixed phones were 27%, and mobile phones were 32.7% by 2006; in Hong Kong, China, the rate was 118%, the highest in the world.

The third generation of communication technology permits phones to transmit sound and data very fast, and it can deal with many forms of content such as pictures, music, and video and provide Internet service, such as DAB (Digital Audio Broadcasting) mobile telephones. Phone development is certain to lead to the appearance of a "mobile phone library," which has already happened in Japan. Readers can read works of popular writers; the Shanghai Municipal Library has opened the business of short message service for readers with its introduction of a "mobile library," which includes the library's open and closing times, booklist retrievals, inquiries about documents, reading sites for reference, and scheduling a course of lectures. CHINA UNICOM and MICROSOFT MSN cooperated to carry out three kinds of business, including MSN Messenger BREW, MSN Messenger WAP, and MSN Messenger short message business, which can link computers with mobile phones, allowing 125 million users of CHINA UNICOM to read on-line. In September 2005, several websites (www.people.com.cn, www.xinhuanet.com, and www.21dnn.com) cooperated to build a website named "The palm world" (Zhang, 2005), which took a mobile phone as its terminus, making mobile phones able to receive information better and faster. Mobile phone users linked with digital-reading rooms are: 1) people whose phones have access to the Internet, 2) people whose telephones can be linked to computers, 3) audio-visual studios, and 4) public spots where video telephone service is provided.

Networks, such as MARC (Machine-Readable Cataloging), OPAC and CALIS of China, make reading rooms more open to the public and the whole society, Telecom, computers, TVs, telephones, broadcasting, and multimedia are developing together, which has changed the environment models of a reading room and made reading room functions much wider.

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